

**CLAIMS**

- 1 1. An object which, in its outer surface contains a color-forming composition which  
2 comprises:
  - 3 a. a solvent-absorbing material;
  - 4 b. a color former compounded with said solvent-absorbing material, wherein said  
5 color former functions as a metal chelating agent; and
  - 6 c. metal ions capable of forming a chelate complex with said color former as said  
7 solvent-absorbing material absorbs said solvent, resulting in a detectable color  
8 change of said composition.
- 1 2. The object of claim 1 wherein said solvent absorbing material is a polymer
- 1 3. The object of claim 2 wherein the solvent absorbing material is selected from the  
2 group consisting of polyethylene acrylic acid, polyethylene methacrylic acid, and  
3 copolymers thereof; terpolymers of polyethylene, an acrylic acid and an acrylate;  
4 polyurethane; poly-(acrylonitrile-butadiene-styrene); polyvinylchloride;  
5 polypropylene copolymer; polystyrene; polyurethane; silicon elastomers; organic  
6 rubbers; and combinations thereof.
- 1 4. The object of claim 3 wherein said solvent absorbing material is polyethylene  
2 methacrylic acid, polyethylene acrylic acid, and mixtures thereof.
- 1 5. The object of claim 4 wherein said color-forming composition exhibits  
2 thermoxidative stability at compounding temperatures of at least about 90<sup>0</sup>C.

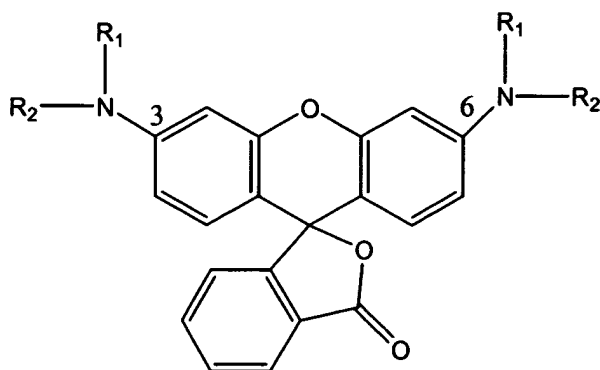
- 1 6. The object of claim 5 wherein said color-forming composition exhibits  
2 thermoxidative stability at extrusion temperatures of at least about 180<sup>0</sup>C.
- 1 7. The object of claim 2 wherein said solvent absorbing material is a paint.
- 1 8. The object of claim 3 wherein said metal ions are selected from the group  
2 consisting of Na<sup>+</sup>, Li<sup>+</sup>, Zn<sup>2+</sup>, Fe<sup>3+</sup>, Fe<sup>2+</sup>, Ca<sup>2+</sup>, Mg<sup>2+</sup>, Li<sup>+</sup>, Ti<sup>2+</sup>, Ti<sup>4+</sup>, Mn<sup>2+</sup>, and  
3 combinations thereof.
- 1 9. The object of claim 8 wherein said metal ion is Zn<sup>2+</sup>.
- 1 10. The object of claim 8 wherein said metal ions are contained in said solvent  
2 absorbing material.
- 1 11. The object of claim 9 wherein the metal ions are provided by zinc acetate.
- 1 12. The object of claim 11 wherein the zinc acetate is present from about 0.1% to  
2 about 2.5%, by weight of the composition.
- 1 13. The object of claim 8 wherein said color former produces a permanent color  
2 change which is not reversed by removal of said solvent from said solvent  
3 absorbing material.
- 1 14. The object of claim 13 wherein said color former is a 1,2-dihydroxybenzene  
2 derivative.

1 15. The object of claim 14 wherein said color former is selected from the group  
2 consisting of 1,2-dihydroxybenzene, 3-methylcatechol, 4-methylcatechol, 4,5-  
3 dihydroxy-1,3-benzenedisulfonic acid disodium salt and 1,2,3-trihydroxybenzene  
4 and mixtures thereof.

1 16. The object of claim 15 wherein said color former is 1,2-dihydroxybenzene and is  
2 present in the composition at from about 0.1% to about 2.5%, by weight.

1 17. The object of claim 8 wherein the color change is reversible when the absorbed  
2 solvent is removed from said outer covering.

1 18. The object of claim 17 wherein said color former is a substituted fluoran  
2 derivative with at least one amine group at positions 3 and 6.



1 19. The object of claim 18 wherein R1 and R2 of the amine group are alkyl groups  
2 containing from one to six carbon atoms independently.

1 20. The object of claim 19 wherein said color former is selected from the group  
2 consisting of 3-diethylamino-6-methyl-fluoran, 3-dimethylamino-6-methyl-  
3 fluoran, 3-dimethylamino-6-methyl-7-anilino-fluoran, 2-anilino-3-methyl-6-

4 dibutylaminofluoran, 3-diethylamino-6-methyl-7-anilinofluoran, and 2-anilino-3-  
5 methyl-6-diethylaminofluoran and mixtures thereof.

1 21. The object of claim 18 wherein a fixative is added to retard reversal of said color  
2 change and wherein said fixative is present at from about 0.1% to about 2.5%, by  
3 weight.

1 22. The object of claim 21 wherein the fixative is a phenolic-based compound.

1 23. The object of claim 22 wherein the fixative is salicylic acid or bisphenol-A, the  
2 acetate derivatives thereof and mixtures thereof.

1 24. The object of claim 1 wherein the object is a golf ball.

1 25. The object of claim 25 wherein said solvent-absorbing material is polyethylene  
2 methacrylic acid; said color-former is from about 0.1% to about 2.5%, by weight  
3 of a 1,2-dihydroxybenzene derivative; and said metal ion is  $\text{Zn}^{2+}$ , in an amount of  
4 from about 0.1% to about 2.5%, by weight.

1 26. A solvent-activated, color-forming composition, comprising:

- 2 a. a solvent-absorbing material;
- 3 b. a color former compounded with said solvent-absorbing material, wherein  
4 said color former functions as a metal chelating agent; and
- 5 c. metal ions capable of forming a chelate complex with said color former as  
6 said solvent-absorbing material absorbs a solvent, resulting in a detectable  
7 color change of said composition.

1 27. The composition of claim 26 wherein said solvent absorbing material is a polymer  
2 selected from the group consisting of polyethylene acrylic acid, polyethylene  
3 methacrylic acid, and copolymers thereof; terpolymers of polyethylene, an acrylic  
4 acid and an acrylate; polyurethane; poly-(acrylonitrile-butadiene-styrene);  
5 polyvinylchloride; polypropylene copolymer; polystyrene; silicon elastomers;  
6 organic rubbers; and combinations thereof.

1 28. The composition of claim 27 wherein said solvent absorbing material is  
2 polyethylene methacrylic acid or polyethylene acrylic acid and mixtures thereof.

1 29. The composition of claim 27 wherein said metal ions are selected from the group  
2 consisting of  $\text{Na}^+$ ,  $\text{Li}^+$ ,  $\text{Zn}^{2+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Li}^+$ ,  $\text{Ti}^{2+}$ ,  $\text{Ti}^{4+}$ ,  $\text{Mn}^{2+}$ , and  
3 combinations thereof and wherein said metal ions are present at from about 0.1%  
4 to about 2.5%, by weight.

1 30. The composition of claim 29 wherein said metal ions are contained in said  
2 solvent absorbing material.

1 31. The composition of claim 29 wherein said metal ions are provided by zinc acetate.

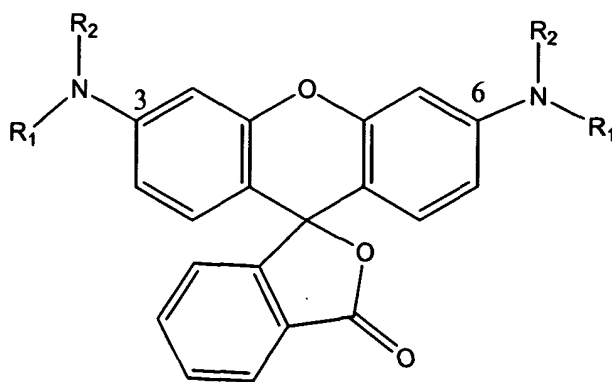
1 32. The composition of claim 29 wherein said color former produces a permanent  
2 color change which is not reversed by removal of said solvent from said solvent  
3 absorbing material.

1 33. The composition of claim 32 wherein said color former is a 1,2-dihydroxybenzene  
2 derivative and wherein said color former is present at from about 0.1% to about  
3 2.5%, by weight.

1 34. The composition of claim 33 wherein said color former is selected from the group  
2 consisting of 1,2-dihydroxybenzene, 3-methylcatechol, 4-methylcatechol, 4,5-  
3 dihydroxy-1,3-benzenedisulfonic acid disodium salt and 1,2,3-trihydroxybenzene  
4 and mixtures thereof.

1 35. The composition of claim 29 wherein said color change is reversible when the  
2 absorbed solvent is removed from said composition.

1 36. The composition of claim 35 wherein said color former is a substituted fluoran  
2 derivative with at least one amine group at positions 3 and 6,



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5 wherein R<sub>1</sub> and R<sub>2</sub> of the amine group are alkyl groups containing from one to six  
6 carbon atoms independently and wherein said color former is present at from about  
7 0.1% to about 2.5%, by weight.

1 37. The composition of claim 36 wherein said color former is selected from the group  
2 consisting of 3-diethylamino-6-methyl-fluoran, 3-dimethylamino-6-methyl-  
3 fluoran, 3-dimethylamino-6-methyl-7-anilino-fluoran, 2-anilino-3-methyl-6-  
4 *dibutyl*amino-fluoran, 3-diethylamino-6-methyl-7-anilino-fluoran, and 2-anilino-3-  
5 methyl-6-diethylamino-fluoran and mixtures thereof.

1 38. The composition of claim 36 wherein a fixative is added to retard reversal of said  
2 color change and wherein said fixative is present at from about 0.1% to about  
3 2.5%, by weight.

1 39. The composition of claim 38 wherein said fixative is a phenolic-based compound.

1 40. The composition of claim 39 wherein said fixative is selected from salicylic acid,  
2 bisphenol-A, acetate derivatives of salicylic acid and bisphenol A, and mixtures  
3 thereof.

1 41. A method for indicating exposure of a color-forming composition to a solvent,  
2 said method comprising:  
3 (a) providing a solvent;  
4 (b) providing a solvent-absorbing material;  
5 (c) compounding a color-former which functions as a metal chelating agent,  
6 with said solvent-absorbing material;  
7 (d) providing metal ions; and  
8 (e) contacting said solvent-absorbing material with said solvent,  
9 whereby as said solvent is absorbed by said solvent-absorbing material, said metal

10 ions contact and chelate with said color former resulting in a detectable color change  
11 of said composition.

1 42. The method of claims 41 wherein

2 said solvent is water;

3 said solvent absorbing material is a polymer selected from the group consisting  
4 of polyethylene acrylic acid, polyethylene methacrylic acid, and copolymers  
5 thereof;

6 said color former is a 1,2-dihydroxybenzene derivative selected from the group  
7 consisting of 1,2-dihydroxybenzene, 3-methylcatechol, 4-methylcatechol, 4,5-  
8 dihydroxy-1,3-benzenedisulfonic acid disodium salt and 1,2,3-  
9 trihydroxybenzene and mixtures thereof; and said metal ion is  $\text{Zn}^{2+}$ .

1 43. The method of claims 42 wherein

2 said solvent is water;

3 said solvent absorbing material is a polymer selected from the group consisting  
4 of polyethylene acrylic acid, polyethylene methacrylic acid, and copolymers  
5 thereof;

6 said color former is a substituted fluoran derivative with at least one amine  
7 group at positions 3 and 6, wherein R1 and R2 of the amine group are alkyl  
8 groups containing from one to six carbon atoms independently;  
9 and said metal ion is  $\text{Zn}^{2+}$ .

1 44. The method of claim 43 wherein a fixative is added to said composition, said

2 fixative comprising acetylsalicylic acid or bisphenol diacetate and mixtures  
3 thereof.